CHEMICAL HYGIENE PLAN

LABORATORY - ASHEVILLE REGIONAL OFFICE
WATER SCIENCES SECTION
2090 US HIGHWAY 70
SWANNANOA, NC 28778

NORTH CAROLINA DIVISION OF WATER RESOURCES

2017 REVISION

TABLE OF CONTENTS:

Revision History Tracking Form:

CHP Revision Date	Reviewed or Modified?	Comments
9/2015	R-C. Johnson, J. Park, M. Overman, K. Jimison M-M. Overman, C. Johnson	Revised section 4; Revised section 10 and added Appendix A for guidance on chemical spills; Added appendix B for information on gloves and chemical resistance; Added ergonomics to section 13; Changed DWR Safety Officer to Department Safety Director or Office.
9/2015	R-Chris Cangemi (DEQ)	Final review and approval by DEQ Safety Office.
7/2016 – 10/2016	R-C. Johnson, J. Park, M. Overman M-M. Overman	Added section (14) for chemical storage and labeling. Updated name of local urgent care center. Added DWR Safety Officer. Revised and updated section 3 (also renamed). Section 11 – added protocol on where disposable gloves cannot be worn, and replacement of gloves. Revised and updated section 15.
10/2017	M- C. Johnson R- M. Overman / C. Johnson	Reviewed content for accuracy Changed DOA fire control officer contact information Changed dates to reflect 2017 review Changed formatting (pagination) Updated list of Particularly Hazardous Substances in appendix

1.0 Chemical Hygiene Plan Overview

In the daily performance of duties in the ARO Laboratory - Asheville Regional Office (part of Water Sciences Section (WSS)), it may be necessary to work with hazardous chemicals and equipment. This may include:

- flammable, corrosive, explosive, carcinogenic or toxic chemicals
- biological hazards
- Physical hazards such as high-pressure gas cylinders, temperature extremes or high voltage equipment

The Chemical Hygiene Plan (CHP) for the ARO Laboratory sets forth the Division of Water Resources (DWR) safe laboratory practices (as part of the North Carolina Department of Environmental Quality). Details of the safe use of chemicals and equipment are also included in the standard operating procedure for each chemical parameter analyzed at the ARO Laboratory.

All laboratory employees are required to be familiar with this Chemical Hygiene Plan (CHP). As with any workplace in DWR, laboratory employees should know:

- The nearest building exit, the evacuation route to that exit and the outside assembly area.
- The location of safety equipment in their lab unit.
- The locations of fire alarm pull stations and fire extinguishers.
- The location of the Safety Data Sheets (SDS) file for their lab unit.

2.0 CHP Applicability

The OSHA standard that governs use of or handling of hazardous chemicals in a laboratory setting is the Occupational Exposure to Hazardous Chemicals in Laboratories lab standard 29 CFR 1910.1450. It only applies to laboratory use of hazardous chemicals in which **all** the following criteria are met:

- Procedures using chemicals are carried out using containers that are easily handled by one person (i.e., manipulations are carried out on a laboratory scale).
- Multiple chemical procedures or multiple chemicals are used.
- Operations involved are not part of a production process, nor in any way simulate a production process.
- Protective practices and equipment are available and commonly used to minimize the potential for employee exposure to hazardous chemicals.

Below is a general summary of the elements of the Chemical Hygiene Standard:

1910.1450(e) Chemical Hygiene Plan - General

(1) Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

(i) Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

(ii) Capable of keeping exposures below the limits specified in paragraph(c) of this section (29 CFR part 1910, subpart Z).

(2) The Chemical Hygiene Plan shall be readily available to employees and employee representatives.

(3) The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

(i) Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals

(ii) Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous

(iii) A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment

(iv) Provisions for employee information and training as prescribed in paragraph (f) of this section

(v) The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation

(vi) Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section

(vii) Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee

(viii) Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

- *Establishment of a designated area*
- *Use of containment devices such as fume hoods or glove boxes*
- *Procedures for safe removal of contaminated waste*
- *Decontamination procedures.*

(*4) The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.*

3.0 Responsibilities of Staff and Safety Contacts

The ARO Laboratory of WSS intends to fully comply with 29 CFR 1910.1450, which is known as the *Occupational Exposure to Hazardous Chemicals in Laboratories* standard and any amendments specific for the State of North Carolina. Every ARO Laboratory employee has the responsibility to ensure the policies as set forth in this program are carried out. To ensure this goal, the following responsibilities are assigned:

Water Sciences Section Chief: Cyndi Karoly

Street: 4401 Reedy Creek Road, Raleigh, NC 27607

Mail: 1623 Mail Service Center, Raleigh, NC 27699-1623

Telephone: 919-743-8416

The overall responsibility for Chemistry Laboratories operations rests with the Water Sciences Section chief. The Section chief shall:

- Assist the Chemical Hygiene Officer and the Department Safety Office in developing long range safety and health goals for WSS Chemistry Laboratory employees.

- Provide the funding necessary to achieve the safety and health goals, including medical surveillance, personal protective equipment, and upgrades to engineering controls.
- Set an example for safety at all times while in the employ of this Division.

WSS Chemistry Laboratory Chemical Hygiene Officer: Chris Johnson

Street: 4405 Reedy Creek Road, Raleigh, NC 27607

Mail: 1623 Mail Service Center, Raleigh, NC 27699-1623

Telephone: 919-733-3908, extension 224.

The Chemical Hygiene Officer (CHO) is the primary person responsible for ensuring that the CHP is implemented throughout the WSS Chemistry Laboratories. The major responsibilities of the CHO are to:

- Provide technical assistance in complying with the Chemical Hygiene Plan and answering questions concerning safety for employees.
- Assist Laboratory managers and supervisors in developing appropriate safety precautions and procedures for the lab units.
- Develop and maintain a system of collection and disposal of chemical wastes, and monitor the Chemical Waste Disposal program.
- Provide to the Division Safety Officer an analysis of any chemical spill or accident within 48 hours of the incident, and develop proposed changes in procedures or policies to improve employee safety and decrease the risk of similar occurrence.
- Maintain a documentation program that includes all accident, injury, incident, inspection, and hood maintenance records.

In conjunction with the Division and Department safety offices, and the DOA Fire Prevention Officer, the Laboratory CHO will:

- Assess possible cases of over-exposure, and determine when an exposure assessment is warranted.
- Establish long-range safety and health performance goals. Communicate with the WSS Chief to discuss safety issues and priorities, annual goals and objectives, funding needs, and long-range plans for improvement.
- Coordination of safety training for WSS Chemistry Laboratory employees.
- Perform routine safety inspections of the Laboratory facilities.

Managers and Supervisors:

The WSS Chemistry Laboratory managers and supervisors are responsible for ensuring this Plan is carried out at the branch and unit level. At a minimum, managers and supervisors are responsible for:

- Providing safe working conditions for all Branch/Unit employees.
- Knowing and implementing the safety and health standards or regulations applicable to the Branch or Unit.
- Ensuring that Standard Operating Procedures (SOP's) for their lab unit(s) include any additional safety information for chemicals, equipment, and processes that are specific to sample preparations and analyses conducted in the lab unit.
- Investigating any employee reports of unsafe working conditions or practices.

- Investigating and reporting accidents or incidents promptly (by the end of the work shift) to the Water Sciences Section chief, the WSS Chemistry Laboratory Safety Committee, and the Division Safety Consultant.
- Ensuring that personal protective equipment is available as needed and ensuring that users are adequately trained in its use, care, and storage.

All Employees:

While in the employ of the Division of Water Resources, each employee has a responsibility to work in as safe a manner as possible. In addition, all employees will:

- Refrain from any unsafe act that might create dangerous conditions.
- Use prescribed safety equipment and personal protective equipment as indicated in this plan and in their lab unit's standard operating procedures (SOPs).
- Be aware of hazardous chemicals in the lab unit; read bottle labels, which provide the most visible and easily accessible safety information for a chemical.
- Consult the **Safety Data Sheet** (SDS) for each chemical used in the lab unit. An SDS provides important information including: Hazards Identification, First Aid and Fire-Fighting measures, Handling and Storage, Personal Protection Equipment, Stability and Reactivity, and Toxicological and Regulatory information. NOTE: Safety Data Sheet (SDS) previously known as Material Safety Data Sheets (MSDS).
- Report **ANY** unsafe condition or act of a coworker to their immediate supervisor, or to the Chemical Hygiene Officer.

Safety Contacts:

Division of Water Resources (DWR) Safety Officer: Chris Cangemi

Street: 517 N. Salisbury Street, Raleigh, NC 27603

Mail: 1617 Mail Service Center, Raleigh NC 27699-1617

Telephone: 919-707-9242 (office/fax)

Department of Environmental Quality (DEQ) Safety Director: Mike Connor

Street: 217 W Jones Street, Green Square Building, Raleigh, NC 27603

Mail: 1607 Mail Service Center, Raleigh NC 27699-1607

Email: michael.connor@ncdenr.gov

Telephone: 919-707-8514 (office); 919-270-3050 (mobile)

Department of Administration (DOA) Fire Prevention Officer: John Morton

Street: 116 W Jones Street, Raleigh, NC 27603

Email: john.morton@doa.nc.gov

Telephone: 919-807-2496 (office)

4.0 Accident / Incident Reporting

Any occupational injury, accident or near-miss incident should be reported as soon as possible to the employee's supervisor and the ARO Office Manager (and the Laboratory CHO).

To call for local Emergency Medical Services (EMS) from a lab telephone, dial: 9-911

Following an accident or injury, the lab unit supervisor and the Laboratory Safety Committee should investigate the incident. The investigation should determine and document the cause of the accident/injury, and whether any modifications to work procedures need to be instituted to reduce the chances of repeat incidents.

Reportable accidents and injuries are to be documented on the Division of Water Resources OSHA 300 form, which is maintained by the Division Human Resources Office.

The OSHA 300 form for the WSS Chemistry Laboratory, for the preceding year, is to be posted on the employee bulletin board located in the main hallway (if there were reportable injuries). The OSHA 300 form will be provided by the DEQ Safety Office.

The following sections provide procedures to follow in case of a work-related accident or injury.

Non-Fatal Injuries, Accidents and Near-Miss Incidents

All accidents and injuries, and near-miss incidents, must be reported as soon as possible to the employee's supervisor (for ARO lab, also report to regional office manager). The supervisor and Laboratory CHO should assist in determining the severity of the injury or accident, and whether professional medical attention is needed and whether emergency personnel should be contacted.

**Note that for an accident or injury (except multi-person injuries or fatalities) that occurs after normal work hours or on a weekend or state holiday, the employee should attempt to contact their supervisor and/or the Laboratory CHO by telephone. If that is not possible, notify the supervisor on the next work day.*

(1) Accident or Near-Miss Incident:

For any work-place accidents or near-miss incidents that occur and could have resulted in an injury, the circumstances and details of the accident or incident, as well as the work process involved, must be documented and investigated.

- Complete the accident/near-miss investigation forms outlined in section 4.4.

(2) Minor injury that does not require professional medical attention:

First-aid kits are available in the laboratory for treating minor injuries such as cuts, scrapes, and small burns. The Laboratory CHO can assist with treatment.

- Complete the accident/near-miss investigation forms outlined in section 4.4.

(3) Injury is not serious or life-threatening but requires professional medical attention:

Provide initial first aid treatment in the laboratory. Transport the injured employee to one of the following facilities:

- Sisters of Mercy Urgent Care, 1833 Hendersonville Rd Ste. 140, Asheville, NC; telephone: (828) 274-1462. (nearest location, 8.6 miles from ARO)

- Sisters of Mercy Urgent Care, 61 Weaver Blvd Suite B, Weaverville, NC; telephone (828) 645-5088.

- Sisters of Mercy Urgent Care, 1201 Patton Ave., Asheville, NC; telephone (828) 252-4878.

Important: Notify the treating facility that the injury is a Worker's Compensation case. Take 2 copies of the **Medical Authorization and Pharmacy** form (see section 4.3).

**Only transport an injured employee if it will not aggravate the injury. If the movement or transport of an injured employee might aggravate the injury, contact EMS and request an ambulance.*

- Follow procedures for Worker's Compensation as outlined in section 4.3.

- Complete the accident/near-miss investigation forms outlined in section 4.4.

(4) Injury is serious or life-threatening:

Immediately contact local EMS by dialing 911 (dial 9-911 if using a lab telephone). If there is **any** doubt as to the severity of the injury, please contact EMS personnel.

The person contacting EMS should provide any information requested by the EMS operator, e.g., the physical address of the ARO laboratory, the nature of the accident and/or injury, and the condition and number of people injured. The caller should remain on the telephone line until otherwise instructed by the EMS operator.

If possible (or if directed by EMS operator), provide initial first aid in the laboratory.

Important: Provide a copy of the injured employee's **Emergency Notification Form** to EMS personnel.

- Follow procedures for Worker's Compensation as outlined in section 4.3.
- Complete the accident/near-miss investigation forms outlined in section 4.4.

Accidents Involving Multiple-Employee Injuries, Hospitalization, Amputation, Loss of Eye(s), or Fatalities:

The North Carolina Division of Occupational Safety and Health requires that the following be reported to NC OSH **immediately:**

- **Accidents involving a fatality**
- **Accidents involving an employee's loss of limb(s) or eye(s)**
- **Hospitalization of an injured state employee**
- **Accidents involving injuries to 3 or more people**

If an accident meets the above criteria, follow the steps below:

(1) Call DWR Human Resources (Wanda Shackleford, telephone: 919-707-9042).

(2) Call DEQ Safety Director (Mike Connor, telephone: 919-707-8514).

(3) During regular working hours (8 a.m. to 5 p.m.), call the NC Department of Labor at 919-779-8560 or 1-800-625-2267.

(4) Outside of regular working hours, or on weekends or holidays, call State Capitol Police at 919-733-3333.

(5) Call a member of the NC OSHR Safety and Health Division (see below). Be prepared to provide contact information, addresses, and telephone numbers for the person(s) involved.

- John Bogner, telephone: 919-807-4897
- Doug Gaylord, telephone: 919-807-4877
- Kathy Connor, telephone 919-807-4824
- NC OSHR: Main Telephone: 919-807-4800; Fax: 919-733-0653

(6) Follow-Up with an email or fax to the one of the above NC OSHR staff.

(7) The NC Office of State Human Resources will notify the Governor's Office and assist in investigation of the incident.

Worker's Compensation Procedures:

The State Government Workers' Compensation Program is administered and managed by the Office of State Human Resources. The purpose of the program is to ensure that all eligible employees who experience a work-related injury or illness receive appropriate medical care and equitable benefits as provided under the Workers' Compensation Act and the State Human Resources Policy.

The State is a self-insured employer and has contracted with a Third-Party Administrator (TPA) to handle the workers' compensation claims of most employees. The TPA is responsible for all compensation and medical bill payments through a workers' compensation fund established by State agencies and universities and administered by the Office of the State Controller, in cooperation with the Office of State Human Resources.

The Laboratory CHO and the WSS Chief should be notified of any worker's compensation cases.

The following forms and procedures are required for Worker's Compensation cases:

(1) Medical Authorization and Pharmacy form:
One copy should be given to the attending physician. The physician should provide the requested physical capabilities information on the form. The completed form should be submitted to the employee's supervisor and the DWR Human Resources Office.

A second copy is for a pharmacy, if needed, and includes a list of authorized pharmacies where prescribed medications may be obtained at no cost to the injured employee.

(2) North Carolina Industrial Commission Form 19 form (titled "Employer's Report of Employee's Injury or Occupational Disease to the Industrial Commission"):

Required by the Worker's Compensation Act.

Responsible Party: The injured employee's immediate supervisor.

Time-Frame: Fill out and submit form within 24 hours of the accident.

Submit form to:

DWR Human Resources Office (Wanda Shackleford)

1617 Mail Service Center
Raleigh, North Carolina 27699-1617
Phone: 919-707-9042
FAX: 919-733-3558

or the **DWR Safety Officer** (Chris Cangemi)

1617 Mail Service Center
Raleigh, NC 27699-1617
Office: (919) 807-6323

- Fill out as much of the form as possible; some information may be completed by DWR HR office.
- Submit a copy of the form by email or fax within 24 hours.
- Submit original of form by hand or inter-office mail as soon as possible.
- Supervisor should keep a copy of the form

(3) WC Release of Information Form:

As soon as possible, the injured employee must submit a signed and dated original of this form to their immediate supervisor. The form must also be signed and dated by the supervisor (or a witness). The supervisor should then submit the form to the DWR Human Resources Office or the DEQ Worker's Compensation Administrator.

(4) Other Forms:

There are other forms that must be completed based on the professional medical care that is needed.

These forms are required to document leave options, mileage, and prescription drug reimbursements associated with a worker's compensation case.

Forms should be submitted to the employee's supervisor, then to the DWR HR Office.

(5) Resources:

The forms mentioned above, as well as procedures for Worker's Compensation, may be found at the following web-pages:

NC Office of State Human Resources:

http://oshr.nc.gov/state-employee-resources/workers-comp/filing-claim

http://oshr.nc.gov/state-employee-resources/workers-comp

DEQ Safety Web-Page:

http://portal.ncdenr.org/group/srm/home

Accident and Incident Reporting Procedures:

All near-miss incidents, accidents, and injuries must be documented using the following forms from the NC Office of State Human Resources. These forms must be completed as soon as possible, and submitted to the employee's immediate supervisor.

The original copies of the completed forms should be submitted to the DEQ Safety Office. Copies may be kept by the supervisor and/or employee, if desired.

(1) NC Employee Incident Report

Required to be filled out by the employee, and then submitted to their immediate supervisor within 48 hours of the incident.

(2) NC Supervisor Incident Investigation Report

Required to be filled out by the employee's supervisor as part of the investigation of the incident. The investigation should begin within 24 hours, if possible.

(3) NC Witness Statement Form

Optional form to be completed by anyone who witnessed the incident, which should be submitted to the supervisor or Laboratory CHO within 48 hours of incident.

(4) Submit package of the completed forms to the DEQ Safety Office within 72 hours of incident.

(5) Resources

The forms mentioned above may be found at the NC OSHR website:
http://oshr.nc.gov/document/incident-investigation-and-reporting-program

This web-page also includes an overview of the reporting process.

Accident Information:

The following information, at a minimum, is to be obtained by the unit supervisor and Laboratory CHO after an accident or injury to assist in documenting and investigating the incident:

- Name of employee(s) involved and contact information.
- Location of incident.
- Date and Time of incident.
- What conditions led to the incident.
- Description of the incident and any resulting injuries.
- Lab Unit(s) of involved employee(s).

5.0 WSS Chemistry Laboratory Safety Committee

The Laboratory Safety Committee at the Central Laboratory in Raleigh, NC meets monthly. If needed, the committee can assist the ARO Laboratory with safety issues and concerns.

Safety Checks:

The ARO Chemistry Laboratory employee is responsible for conducting regular safety checks within their laboratory. The safety checks should be recorded, and any deficiencies should be reported to the unit supervisor and/or the Laboratory CHO.

Routine safety check procedures are:

1. Monthly, each of the eyewashes and drench hoses in the lab, whether located at a lab sink or at a safety shower, should be checked for proper water flow.
2. Monthly, safety showers in the lab should be operated for several seconds to flush the pipes and to check that water is flowing properly. A nylon sleeve, attached to PVC plastic handle, is used to direct water from the shower into a bucket.
3. Monthly, the fire extinguishers located in the lab area should be checked. See section 14.4 for more information.

4. Quarterly, the fume hoods in the lab area should be evaluated. See section 19.2.3 for more information.

6.0 CHP and Safety Training

It is the direct responsibility of the Managers, Unit Supervisor, and Central Laboratory CHO to ensure that safety training is available to employees. It is the employee's responsibility to make maximum use of the training opportunities provided to them.

New Employee Orientation and Training

On employment at the ARO Laboratory, new personnel (permanent, part-time, temporary, interns, etc.) will be oriented to the general safety procedures in the laboratory and will be given the opportunity to read the Chemical Hygiene Plan. This initial orientation and training should be documented on form *TRF-002-1* (see Appendix). Each new employee will be required to sign a form (*TRF-003-1*; see Appendix) indicating that orientation information was made available, that they have reviewed the Chemical Hygiene Plan, and understand the information contained in those documents. The employee's Unit supervisor will allow adequate time, **before beginning work**, to read the documents and clarify any areas that are not understood. The above forms should be kept in the ARO Laboratory training files.

New employees of the ARO Laboratory will receive a general safety orientation, which will, at a minimum, include:

- Use of chemicals in the Laboratory, the hazards associated with those chemicals, and appropriate chemical waste disposal procedures.
- Accident / Incident prevention and reporting procedures.
- Laboratory fire safety and evacuation plans.
- A tour of the Laboratory facility.

Additional ARO Laboratory Training

Additional training courses will be made available from time to time. These courses may be mandatory or optional, depending on the topic. Employees are required to attend all mandatory training and are encouraged to take any optional training. Optional training may include such training as First Aid or CPR training.

7.0 CHP Medical Surveillance

All employees in the ARO Laboratory should receive a baseline physical within **3-6** months of working in the Laboratory. Employees may also receive a physical periodically during their employment with the ARO Laboratory. These examinations are provided at no cost to the employee.

8.0 Visitors to the ARO Chemistry Laboratory

Persons not in the employ of the ARO Laboratory should be considered visitors to this site. Access to the ARO Laboratory building is to be regulated as the Water Sciences Section does enforce the FDA and EPA rules regarding chain of custody for some of the samples entering this building. Certain individuals that frequent the premises may, after initial orientation and hazard training, be allowed to forego the visitor sign in process. Determination of exclusion from the normal visitor process will be done on a case by case basis for these persons.

Prior to entering a restricted area:

1. Visitors will receive a safety review for the specific area before they proceed to that area.

2. Visitors will be issued appropriate personal protective equipment for that area
3. Repairmen, maintenance personnel, or construction employees will be instructed in the hazards associated with areas around their work sites.
4. Visitor injuries require an Incident Investigation report be completed and forwarded to the Unit Supervisor, the Laboratory Safety Committee, the Section Chief and the Department Safety Office.

9.0 CHP Review and Update

In compliance with the current OSHA regulations concerning the Laboratory Standard, 29 CFR 1910.1450, and any amendments made to those regulations by the North Carolina Department of Labor's Division of Occupational Safety and Health, the Chemical Hygiene Plan will be reviewed and updated on an **ANNUAL** basis. The review process will include coordination with the WSS Laboratory Safety Committee, Lab Chemical Hygiene Officer, and the Department Safety Office. If substantial changes are made to the Plan during this process, all ARO Laboratory employees will receive updated training in the changes made to the Plan.

10.0 CHP Emergency Response

The potential for an emergency to occur at the ARO Laboratory is very real. The Laboratory has on premises potentially hazardous chemicals, compressed gases, potentially carcinogenic materials, flammable and combustible liquids, and other similar types of materials. Types of emergencies that can occur include but are not limited to:

- Fires
- Chemical Spills
- Biologic Contamination
- Security Threats

The general form of response will be to perform either a general or local area evacuation.

General Evacuation

A general evacuation requires all persons to exit the laboratory area and ARO building. Routes and exits are marked by exit sign, which should be displayed at main exits.

Local Evacuation

A local evacuation does not require exit from the building. Occupants of the laboratory area should leave and assemble in the hallway outside the lab, at an appropriately safe distance. Do not hinder emergency or cleanup operations.

Take the SDS file to the safe distance location if safety permits.

Specific Evacuation Procedures:

Fire

Activate the nearest pull alarm. Leave the area and ensure that all other personnel in the affected area have been evacuated. Call **9-911** to activate the fire emergency services. Proceed with the general evacuation plan and assemble at the outside assembly area.

Gas Leaks

In case of a leak of an explosive, flammable, asphyxiating or corrosive gas, proceed with the general evacuation plan.

Chemical Spills

The nature of the chemical spill will determine the level of evacuation and emergency response. Treat all chemical spills with appropriate caution.

Determination of the appropriate cleanup or emergency response measures will be made from the evacuation assembly location.

Determination of the appropriate cleanup or emergency response measures will be made from the evacuation assembly location.

Types of Spills:

- A small spill is defined as a spill that involves the equivalent of less than 500 milliliters of a chemical substance and the substance is not a highly hazardous substance. For small spills, perform the necessary evacuation to a local evacuation point, and refer to the chemical specific Material Safety Data Sheet (MSDS) for appropriate cleanup procedures, personal protective equipment to be utilized, and for any other safety related precautions.
- A large spill is defined as a spill of a substance that involves the equivalent of 500 milliliters or more and the substance is not a highly hazardous substance. A large spill may necessitate the evacuation of the Laboratory building or a substantial portion of the building.
- For spills involving particularly hazardous substances, such as asphyxiating, explosive, highly reactive, etiologic, or flammable chemicals, proceed with the general evacuation procedure.

Chemical Spill Plan:

An important part of a safety plan is the review of all possible spills ahead of time. The Chemical Spill Plan for the DWR Central Laboratory (also applicable to the ARO lab) is located in Appendix A and provides guidelines for assessing the potential for a spill and how to respond in the event of a spill.

For each lab unit, the necessary spill control materials should be readily at hand and all personnel should be trained in their use. Spill control items should include powders for neutralizing acids/bases and for absorbing organic solvents, absorbent pads and pillows, and waste bags or containers.

Medical Emergencies:

A medical emergency is defined as a situation where a person is injured to an extent greater than first aid measures can accommodate and the affected person needs professional medical attention. Types of medical emergencies may include deep cuts or punctures, thermal or chemical burns, eye injuries, and similar conditions. If a medical emergency is serious or life-threatening, contact EMS via telephone by dialing **9-911**, and request an ambulance or other emergency service to respond. Stay on the telephone until instructed otherwise by the EMS operator. If a medical emergency is determined to not be serious or life-threatening, and the injured employee can be transported **SAFELY** and without any further injury or aggravation, state automobiles may be utilized to transport the employee to a local hospital or emergency care center (see section 4.1).

Other Threats:

Other threats may necessitate a general evacuation or emergency response. These evacuations and responses may be called by management, other safety personnel, or local emergency or law enforcement personnel. Follow the instructions given by the management team, or other EMS personnel in charge.

City Water Outage: In case of a city water outage to the ARO facility, the laboratory fire/sprinkler system should remain functional but eye washes and safety showers will not work. Any procedures that may pose a safety hazard requiring possible use of eye wash or safety shower should cease or not be performed.

Tornado: If a tornado warning is issued for the area of the ARO Laboratory building, employees will be directed to move out of rooms with large windows. Employees should move into the central hallway, or a room without windows (e.g., break room). Do not return to regular work areas until cleared to do so. A weather radio should be maintained in the lab area.

Drills:

General evacuation drills (fire drills) should be arranged by the Asheville Regional Office manager.

11.0 Personal Protective Equipment

The Division provides certain personal protective equipment to employees at no cost. This equipment is made available for personal protection. Do not misuse or abuse the equipment. Misused and abused equipment will be replaced at the employee's expense.

Hazard Assessment:

The Department Safety Office, in conjunction with the Central Laboratory CHO, should perform job hazard assessments as needed on the basis of a significant change in procedure or equipment. The reason for a job hazard assessment is to indicate all personal protective equipment that will be needed to perform the job safely. Training will be given in the appropriate fitting, use, care, and storage of any personal protective equipment that is issued.

Eye Protection:

Division policies require the use of eye protection when there is a reasonable probability of eye injury. Appropriate protective devices shall be worn by employees and visitors in all areas identified as Eye Hazard areas. There are no exceptions to this policy.

Contact lenses can trap and retain chemicals and vapors from the air and caution should be used when wearing contact lenses in areas where laboratory chemicals are used or stored.

Types of Eye Protection:

Various types of eye protective gear may be used in the ARO Laboratory. The specific type will be determined during the Job Hazard Assessment. Various types and sizes of eye protection will be available for use by employees and visitors. This may range from simple impact resistant eye wear to splash resistant goggles.

Employees that normally wear prescription eye wear and are required to wear safety eye wear while performing their jobs will be able to obtain safety eye wear through specified suppliers. Any cost of the eyewear above the authorized cost will be borne by the employee.

Eye Wash Equipment:

An eye wash station is located in the ARO Laboratory. It is the responsibility of each employee to ensure they know the location of the eye wash station. If eye washing is necessary, washing is to be performed for a minimum of **15 MINUTES**.

The eye wash station is to be tested by laboratory personnel monthly to ensure that this equipment is operating properly. Appropriate documentation of the testing will be maintained by the employee and archived by the Central Laboratory CHO.

Face Protection:

A full-face visor may be needed when:

- Handling concentrated acids or bases
- Using flammable solvents
- Heating glassware
- Using equipment when contents are under pressure

Hand and Foot Protection:

Gloves, of the appropriate type, are to be worn when handling:

- Chemicals (At minimum, use the Nitrile disposable type)
- heat sources
- extremely cold (subzero F) substances
- soapy glassware that is being washed

Disposable nitrile gloves are the standard hand protection in the laboratory and should be worn when handling chemicals or samples. Note: Disposable Nitrile gloves may only provide short- term protection from some solvents and concentrated chemicals. See Appendix B for guidance on types of gloves and chemical resistance.

Protocol for disposable safety gloves:

- Do NOT wear disposable safety gloves in common areas such as the break room, rest rooms, or front office.

- When handling hazardous chemicals (e.g., acids or solvents) or samples that contain animal or human waste, replace disposable gloves as often as needed for self-protection and to prevent contamination of lab equipment/surfaces.

Any dermatitis or allergies should be reported to the employee's supervisor or the CHO, and must be evaluated by the Department Safety Office. If needed, disposable gloves made from a different material should be ordered.

Thermal gloves are to be worn when handling extremely cold or hot objects or substances.

Appropriate chemical protective gloves are to be worn in addition to the disposable gloves when handling hazardous chemicals. Specific types of chemicals may require gloves made of specific material and greater thickness, especially if exposure to the chemical will be prolonged. Consult the SDS and vendor information to determine the glove material that provides the maximum amount of protection.

As an extra precaution, employees should wash their hands thoroughly and immediately after handling samples or chemicals.

Proper clothing and foot covering are vital to individual protection. Shorts, sandals and open-toed/ heeled shoes are not to be worn in areas where chemicals are handled and/or samples are processed and analyzed.

Torso Protection:

Lab coats are to be worn whenever employees are actively running tests, setups, or handling chemicals. The lab coats are to be buttoned to protect the wearer's street clothes. The laundry facility is to be used to clean the lab coats (do not take these coats home to launder).

Chemical resistant aprons should be worn when handling large volumes of concentrated acids and bases.

12.0 First Aid

General:

While on the job, any injury that occurs is to be reported to the employee's immediate supervisor. In the ARO Laboratory, no personnel are designated as first aid responders; employees are not required to administer first aid, but can do so if they have received training.

More severe injuries will require attention from a medical provider. If medical attention is sought, the incident is to be formally reported, in writing, to the employee's supervisor and to the Department Safety Office. See Section 4, Accident and Incident Reporting, for further information.

Chemical Exposure and First Aid:

If an employee is exposed to a chemical, quick response is essential. For eye contact (see section 11.2.2) and for skin contact, immediately flush the area with water for a minimum of 15 minutes. For serious chemical exposures, employees are to be transported to the closest medical facility via EMS. A copy of the SDS for the chemical should to be taken with the employee so that the medical provider will know the type(s) of chemical(s) involved.

- **Chemical Contact to Body:**
  1. Quickly remove all contaminated clothing and begin using a safety shower or drench hose. Begin flushing the affected body area with water as soon as possible. Be careful to avoid spreading the chemical to surrounding skin or into the eyes.
  2. Flush the affected body area with cold water for at least 15 minutes. Resume if pain returns.
  3. If possible, wash off chemicals with a mild detergent and water. Do not use neutralizing chemicals, unguents, creams, lotions, or salves.
  4. Get professional medical attention as soon as possible. Provide medical personnel with the exact chemical name so that proper treatment may be started as soon as possible.

Equipment on Site:

The ARO Laboratory has one first aid kit on site.

- **Automated External Defibrillator**

The ARO building has an Automated External Defibrillator (AED) located in the break room. The AED is used to administer an electric shock to a fibrillating heart of a victim in order to bring the heart back to its sinus rhythm. When the AED is removed from its case and the face plate is opened, automated voice instruction begins giving step-by-step directions for use on a victim. One of the steps will indicate that the chest is to be fully exposed by removing all clothing in that area so that the contact pads can be properly placed and secured on the skin. The device will then determine if shock is needed.

Light emitting diodes (LEDs) indicate status of the AED and batteries; the LEDs will flash green every few seconds when the AED is fully functional. The battery for the AED should be replaced as needed, and will generally last for 5 to 7 years. The AED paddles should be replaced prior to the expiration date printed on the paddles.

The status indicator light is to be checked monthly.

Important: The AED is intended as first aid; call 9-911 immediately for local EMS.

First Aid Training:

All employees in the ARO Laboratory will have the opportunity to attend First Aid, CPR and AED training. The training is optional and personnel taking the training will not be identified as Division first aid responders. The training will be scheduled and provided by the Department Safety Office. Employees obtaining this training will be certified in First Aid and CPR practices through the National Safety Council in conjunction with the Safety and Health Council of North Carolina.

13.0 Work Area Safety and Housekeeping

Laboratory areas are to be maintained in a clean and orderly manner, and chemicals and lab equipment are to be properly stored and labeled. In addition, the following safety and housekeeping rules apply to all working areas of the ARO Laboratory:

1. For Personnel and Fire Safety reasons, cell phone use (including Bluetooth and other "handless" technology) is **NOT** permitted while performing laboratory procedures, especially when working with hazardous chemicals (e.g., flammable liquids and corrosives).
2. Food and consumption of food items is **ONLY** permitted in defined areas. Consumption of food and beverage items is **NOT** to be permitted where laboratory operations are being performed.
3. Glassware and utensils for laboratory operations are not to be used for food preparation or consumption. Laboratory coolers and chemical storage freezers or refrigerators should never be used for food storage.
4. Glassware is to be rinsed immediately following use to prevent others from coming in contact with chemical residues left in or on the items.
5. Work areas are to be cleaned promptly after use and to be kept free from obstruction.
6. Un-labeled containers and expired chemicals are to be disposed of properly and in accordance with appropriate procedures. Materials and chemicals no longer needed are not to be allowed to accumulate in the laboratory.
7. Large bottles (3 liters or larger) of hazardous liquids (e.g., acids, solvents) must be transported using a rubber bottle carrier or a lab cart.
8. **Broken Glassware**: All broken glassware, as well as Chromatography needles and Pasteur pipets, must be placed into waste containers designated solely for broken glassware. Each container should be lined with a puncture-resistant bag. When full, the top of the bag should be secured and the box transported to the outside dumpster.
9. Never force glass tubing into a rubber stopper.
10. Floors are to be cleaned regularly. Spills should be cleaned up immediately. Keep floors free of slip, trip or fall hazards.
11. Place trash cans and personal items where they will not present a trip hazard.

12. Access to exits, emergency equipment, and building control devices must be unobstructed at all times. A 44-inch pathway of egress should be maintained through all areas of travel in the laboratory.
13. Stairways and hallways are not to be used as storage areas.
14. Cords and plugs hanging or protruding from lab equipment or fume hoods should be secured. Extension cords should be considered as temporary only. Only one power strip should be used per electrical outlet (do **not** connect one power strip to another power strip).

Ergonomics:

Laboratory procedures or work tasks that require repetitive motions, heavy lifting, bending, or long periods of standing have the potential to cause musculoskeletal disorders affecting the muscles, nerves and tendons. The neck, arms, and lower back are body areas of particular concern regarding ergonomics, which basically is a process of trying to fit a procedure or task to the worker in a way that minimizes any chronic health issues.

If any of the above issues are a concern, an employee should notify their immediate supervisor or the Laboratory CHO. The supervisor and CHO should assess the procedure or task to help determine what options are available to minimize discomfort and risk of chronic injury. The solution may involve training and/or a change in work controls or equipment. The CHO should follow up to ensure that the ergonomic issue has been addressed and that the solution is effective.

14.0 Chemical Storage and Labeling

To insure workplace safety, all chemicals and prepared reagents must be stored and labeled based on the following guidelines. These guidelines are intended to assist both employees and emergency personnel in identifying chemical hazards in the laboratory.

Chemical Storage Guidelines:

All chemicals and prepared solutions in the laboratory must be stored properly and safely. For each chemical or solution, this includes consideration of any specific storage requirements based on chemical hazards, compatibility with other chemicals, and ease of accessibility.

For any chemical, the first step in determining safe storage conditions and any specific requirements is to consult section 7 of the relevant SDS.

For information regarding stability and reactivity, as well as conditions to avoid and incompatible chemicals/materials, consult section 10 of the relevant SDS.

Storage of chemicals in the laboratory must adhere to the following:

1) Storage conditions for a chemical must adhere to the relevant SDS (specifically sections 7 and 10).
2) Separation of stored chemicals based on hazard classifications and chemical compatibilities. Separate, clearly labeled storage locations must be established for major hazard classes.
3) Maintenance of the lowest possible quantities of hazardous chemicals. Do not accumulate excess containers of expired or unused chemicals.

Special considerations for major hazard classes:

1) **Flammable and combustible chemicals**:

   Chemicals that are easily ignited and present serious risks of fire and/or explosion. Storage areas must be free of ignition sources and static electricity, include adequate ventilation to prevent build-up of fumes, and be clearly labeled to assist emergency personnel. Containers of flammable chemicals must be stored inside a flammable storage cabinet or designated storage room (e.g., room G102 in chemistry

lab building). Combustible materials should be stored either in a flammable storage cabinet, or in a fume hood cabinet with secondary containment.

- Store separately from other hazard classes, especially oxidizers and toxics.
- Only use squeeze bottles and secondary containers that are approved for flammable liquids (e.g., properly labeled; self-venting; non-drip).
- Squeeze bottles of flammable solvents may be stored on lab counter-tops or inside a fume hood as long as the bottle is clearly labeled as containing a flammable liquid and there are no signs of leakage.

2) **Corrosives**:

Concentrated acids and bases can destroy skin tissue, cause serious eye and respiratory damage, and corrode metal. Acids and bases must be stored separate from each other, and may react with many other classes of chemicals. Keep neutralizing materials nearby.

Always segregate concentrated acids from chemicals that produce toxic gases and any chemicals that contain water-reactive metals (e.g., magnesium, potassium, sodium).

- For containers of concentrated corrosives, especially for volumes > 1 gallon (4 liters), provide secondary containment (polypropylene pan or tray) to contain and isolate any leaked material.

3) **Oxidizers**:

Chemicals that are a fire hazard due to decomposition to produce oxygen or promotion/initiation of flammable and combustible materials. Store in cool, dry areas. Oxidizers must be stored separately from other hazard classes, especially reducing agents, flammable chemicals, and combustible material (e.g. paper, Styrofoam).

4) **Water-Reactive Substances**:

Chemicals that react to water; reaction may cause ignition of substance, or generate corrosive, flammable, or toxic gases. Store in cool, dry area; do not store near a sink or sink drain.

5) **Toxics**:

Chemicals that can cause injury or death from overexposure. Toxic chemicals used in the WSS Chemistry Laboratory are included in the list of *Particularly Hazardous Substances* (see appendix). Store separately from other hazard classes. Store containers in well-ventilated areas and away from light and heat; keep containers tightly sealed to minimize exposure to lab personnel.

6) **Peroxide-forming and Explosive Chemicals**:

Potentially explosive chemicals can cause serious injury or death; an explosion may be initiated by friction, heat, or static electricity. Keep all potentially explosive and peroxide-forming chemicals away from all ignition sources, including open flames, hot surfaces and direct sunlight. Store containers separately from all other hazard classes.

In the WSS Chemistry Laboratory, diethyl ether and isopropyl ether are peroxide-forming chemicals used in the Organic Chemistry Branch. Over time, these chemicals can form peroxide crystals that may explode (e.g., when the cap on a bottle is removed). The lowest possible quantity of these chemicals should be stored in the laboratory. Bottles must be labeled with receipt date and date first opened; if possible, do not use beyond 1 year from opening. Keep bottles tightly sealed when not in use and regularly inspect the bottle opening, cap, and contents for crystal formation. If crystals are observed, do not open bottle; immediately contact the Laboratory CHO.

<u>Additional storage recommendations</u>:

- Containers of hazardous liquids must be stored no higher than eye level.

- Chemicals should never be stored in direct sunlight or near heat sources (e.g., laboratory oven or autoclave).
- Minimize storage of chemical containers inside of fume hoods. Containers stored inside of a fume hood must not interfere with air flow.
- Avoid storing containers directly under sink drains.
- Storage shelves should be stable and well-secured; containers should not protrude over the edge of shelf. Store large bottles and containers no higher than 2 feet above floor or counter-top.
- For liquids, use secondary containment to confine any leaks or drips.

Chemical Container Labeling:

All containers of chemicals and lab-prepared reagents/solutions are to be labeled for easy identification; at a minimum, the chemical/reagent name, date of preparation, and concentration (if applicable) must be clearly visible.

If a chemical or reagent will be stored in a container for more than 24 hours, then the container label must also include hazard identification information. Any hazardous chemicals present in the container should be identified along with related hazards. Hazard identification should follow guidelines established in the 2012 update of the Hazard Communication Standard, including signal word, hazard pictograms, and hazard statement(s).

Manufacturer Labels:

Containers of purchased chemicals and vendor-prepared reagents/solutions must have manufacturer-applied labels that include the following:

- Chemical name or identification of contents of container
- All applicable hazard warning statements and pictograms for physical and health hazards
- Name, address, and emergency telephone number of manufacturer

The manufacturer label must remain on a container, and should not be covered or damaged in any way. Labels must remain legible and in good condition.

Dates when container was received and opened should be written on the container label. Laboratory identification numbers may also be written on the label, as long as safety information is not obscured.

Laboratory Container Labeling:

Containers of lab-prepared reagents and solutions (e.g., flasks, bottles, beakers) and secondary containers for chemicals and vendor-prepared reagents/solutions must be clearly labeled with:

- Name of chemical or reagent
- Date of preparation.

If used for a hazardous chemical or lab-prepared reagent/solution that contains a significant amount of a hazardous chemical, then the container must be labeled with the following:

- Hazard Signal Word (Danger or Warning)
- Hazard pictograms and/or NFPA Chemical Hazard diamond (see below)
- Hazard statement(s) for most significant hazards

Note these requirements also apply to squeeze bottles and bottles used for bottle-top dispensers. This type of labeling may also be used for chemical storage cabinets and areas.

Hazard Identification Systems:

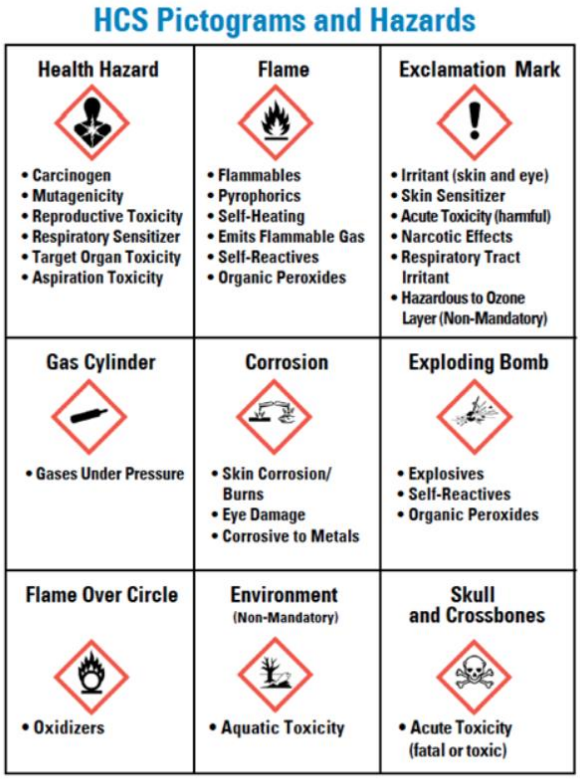
There are two systems in place for quick identification of physical and health hazards of a chemical (or storage location for a group of chemicals):

1) Hazard Communication Standard (HCS) Pictograms
2) National Fire Protection Association (NFPA) hazard identification diamond

HCS Pictograms:

This hazard identification system is now required as per the 2012 Hazard Communication Update from OSHA. Although this requirement is specifically for chemical manufacturers and distributors, it can also be used for laboratory labeling.

Each pictogram consists of a symbol on a white background framed with a red border and represents a specific hazard. The pictogram(s) required for a particular chemical is/are based on the chemical's hazard classification(s). The nine pictograms are illustrated below:



NFPA Diamond:

NFPA hazard identification diamonds are intended to assist emergency response personnel in addition to employees. The diamonds can be posted on buildings or doors to identify the level of hazards for that building or room, or can be part of a chemical container label.

An NFPA diamond consists of 4 colored diamonds; the numbers and abbreviations within these smaller diamonds indicate the level of hazard:

- Blue diamond = Health – based on short-term exposure to chemical by eye/skin absorption or inhalation
- Red diamond = Flammability – ease with which chemical will ignite if exposed to spark, open flame, heat

- Yellow diamond = Reactivity – chemical's instability, reaction to water, sensitivity to friction/shock
- White diamond = Special Hazards – OX for oxidizers; COR for corrosives; ~~W~~ for water-reactive

The Health, Flammability, and Instability diamonds will have a number from 1 to 4, with a rating of 4 indicating the highest degree of hazard. For example, a "4" in the Flammability diamond indicates that the chemical is extremely flammable.

15.0 Laboratory Fire Safety

Fire System Controls:

The ARO building is equipped with a fully automatic, supervised sprinkler system. In the event of fire that begins to engulf a room of the building, the system will activate to control the spread of fire until the city Fire Department arrives on site. This system is inspected quarterly and is maintained in operable condition by Facility Management personnel.

Fire extinguishers are located throughout the ARO Laboratory building; there are 2 fire extinguishers located in the laboratory area. All personnel are expected to know the location of the nearest fire extinguisher(s). Fire extinguishers are only to be used in initial-stage fire control.

In addition to the automatic sprinkler system and fire extinguishers, the building is equipped with a fire control system. In case of fire, the building fire control system will activate the audible alarms. When the audible alarms are heard, employees should immediately leave the building using the most convenient and safest exit.

Fire Extinguishers:

Fire extinguishers are provided in the laboratory room as well as in the ARO building. All of the fire extinguishers in the ARO Laboratory building are ABC-Dry Chemical. All fire extinguishers are to only be used on small fires for initial stage firefighting. The dry chemical-Class ABC extinguishers are applicable to the following types of fires:

Class A: Paper, wood, cloth, trash, and plastic materials.

Class B: Flammable liquids (gasoline, oil, grease, acetone), flammable gases.

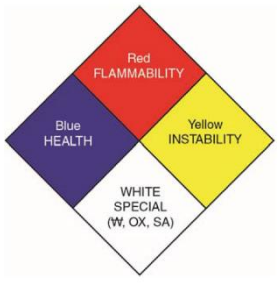
Class C: Electrical equipment; energized electrical equipment fires.

To use a fire extinguisher, hold the extinguisher by the bottom handle in one hand. Remain at least 4 feet away from the fire with a safe exit nearby. Then follow the basic procedures of *PASS*:

P – Pull the pin from the handle of the extinguisher

A – Aim the discharge nozzle at the base of the fire

S – Squeeze the handle to begin discharge of the extinguisher



S – Sweep the discharge nozzle from side to side, aiming at the base of the fire

Other Fire Safety Equipment:

* Fire alarm pulls are located at each of the major building exits.
* Safety shower is located in the laboratory room.

Inspections and Training:

1. Each **fire extinguisher** in the laboratory room is to be visually checked on a monthly basis. Each extinguisher should be checked for the following:

- Visible and easily accessed – no material, boxes, etc. in front of the extinguisher.
- The safety pin in the handle of the extinguisher is intact and secure. The safety pin prevents a fire extinguisher from being accidentally activated.
- Extinguisher's handle is intact and not bent or broken.
- Label on extinguisher is clear and legible; extinguisher type and instructions are easy to read.
- The needle of the pressure gauge is in the green area, which indicates that the extinguisher is at the proper pressure. If the needle is outside of the green area, immediately notify the Laboratory Chemical Hygiene Officer.
- Check the extinguisher's discharge hose and nozzle. The hose should not have any cracks or signs of wear, and the nozzle should be free of debris or unobstructed.

If any of the above items are not satisfactory, then notify the Laboratory Chemical Hygiene Officer. The CHO should then contact the Department of Administration's Fire Prevention Officer, who can assist in having the extinguisher repaired or replaced.

If all of the above items are acceptable, then initial the inspection tag (in appropriate month and year space) attached to the extinguisher to indicate that the extinguisher has been checked and is in working condition.

If all of the above items are acceptable, the inspection attached to the extinguisher should be initialed to indicate that the extinguisher has been checked.

An annual maintenance check of all extinguishers is to be performed and documented by General Services (Fire Safety Office). Hydrostatic testing of the extinguishers is to be performed for all extinguishers in the ARO Laboratory every twelve years.

All personnel will be instructed in the basic fire hazards associated with normal ARO Laboratory operations during their initial assignment training and on an annual basis thereafter.

Fire Prevention Procedures

Each employee needs to understand the potential fire hazards with a particular procedure or for daily activities of a non-analytical nature. This involves an understanding of reagents and equipment, their nature and function. Fire prevention information is contained in the material safety data sheets for the chemical reagents and the operator's manuals for instrumentation and equipment.

Assume that a fire will take place. Be aware of the probability of fire and plan accordingly. Laboratory fires are generally localized and small; however, there is a potential for a fire to spread out of control. The potential for damage and loss of life must be stressed in order to insure the effectiveness of fire prevention guidelines.

The following represent the minimum operating procedures for fire prevention.

1. Smoking is prohibited inside the laboratory area or ARO facility.
2. Notify the ARO Manager or Central Laboratory CHO immediately of potentially dangerous situations.
3. Do not use an open flame to heat a flammable liquid or to carry out a distillation under reduced pressure.
4. Use an open flame only when necessary. Before lighting a flame, remove flammable materials from the immediate area.
5. Use fume hoods during transfer or analysis of flammable solvent(s) to prevent the formation of flammable mixtures.

6. **Store flammable materials properly**.
    * Containers must be properly labeled.
    * Flammable liquids are to be stored in NFPA-approved storage cabinets. Cabinets should be ventilated if possible.
    * Eliminate possible contact of flammable liquids or gases with strong oxidizing agents, such as chromic acid, permanganates, chlorates, perchlorates, and peroxides.
    * Exclude ignition sources from flammable storage areas.
7. When dispensing and handling flammable substances, ensure that the area is free of potential ignition sources (including cell phones).
8. Before leaving a lab area at the end of a work day, be sure to turn off all hot plates, open burners, and other devices with heat elements.
9. A smoke detector should be located in laboratory area. The detector should be checked on a monthly basis by pressing the test button, which activates the audible alarm if batteries are still functioning properly. Batteries should be replaced on an annual basis, or if the alarm does not sound during testing.

16.0 Compressed Gases

Currently, there are no compressed gas cylinders located in the ARO laboratory area.

17.0 Electrical & Mechanical Hazards

Electrical Hazards:

1. DO NOT TOUCH a person in contact with a live electrical circuit. DISCONNECT THE POWER FIRST or further serious injury may occur.
2. Plug equipment into outlets designed to carry the ampere rating of the equipment. All electrical outlets are to be grounded. Electrical outlets in wet areas or within six linear feet of a water source should have ground fault circuit interruption (GFCI) protection.
3. If an electrical cord is worn, frayed or damaged, repair immediately or mark the cord or equipment as not to be used.
4. Beware of the explosion hazard of hot plates and flammable liquids under the hoods. Maintain a clear area around cooling fans and vents.
5. Keep electrical cords free and not kinked. Turn off unnecessary electrical devices during weekends and holidays.
6. Computers are to be connected to surge protection devices.
7. Avoid overloading electrical outlets with multiple plugs for related equipment.
8. Combustible items are to be kept away from heat sources.
9. Refrigerators constitute a unique hazard because explosions may occur when they are used for storage of volatile or unstable chemicals. Domestic (house-hold type) refrigerators shall not be used for chemical storage unless they are modified by eliminating open electrical contacts and by having the door closures replaced with magnetic door closures.

Mechanical Hazards:

1. Only trained and designated personnel are to perform maintenance activities on laboratory equipment or testing devices.
2. Personnel performing maintenance procedures on equipment are to wear appropriate personal protective equipment.
3. Compressed air is not to be used for cleaning purposes unless the air pressure has been reduced to less than 30 psi.

18.0 Vacuum

The term, "vacuum" refers to the condition of an enclosed space that is devoid of air, gases, or other material content. In the Chemistry Section Laboratories, vacuum that is used is more appropriately called a "partial vacuum" because the entire area under reduced pressure is not totally devoid of gas particles. Vacuum used in the ARO Laboratory is generally in the range of five (5) to ten (10) inches of mercury (vacuum).

Safety Considerations:

A vacuum apparatus probably presents fewer accidental hazards than almost any other kind of lab apparatus. However, these hazards are by no means entirely negligible. The vacuum hazards most likely to occur in the laboratory are:

1. **Implosion**
   This type of hazard is most important with glass apparatus, and is ever-present when large glass bulbs (over one liter in size) or flat bottom vessels (of any size) are evacuated. The force of atmospheric pressure makes dangerous missiles of glass fragments from imploding vessels. Only use vessels that have been designed for vacuum. Reduce the possibility of flying glass by placing strips of plastic electrician's tape on all large glass evacuation vessels.
2. **Explosion**
   When a vacuum system liquefies significant quantities of a gas, or condensate is taken up by an absorbent at a low temperature, an explosion can result when the system warms up if adequate vents or safety valves have not been provided. An explosion of a different kind can take place if an oil diffusion pump (particularly a glass one) is vented to air while hot.

Water Aspirators:

Aspirators for reduced pressure are used mainly for filtration purposes. Only equipment that is approved for this purpose should be used. These recommendations also apply to rotary evaporation operations where water aspirators are being used for vacuum.

1. Never apply a vacuum to a flat-bottomed flask unless it is very small or it is a heavy-walled filter flask designed for filtration.
2. Place a trap and a check valve between the aspirator and the apparatus so that water cannot be sucked back into the system if the water pressure should fail unexpectedly.

19.0 Autoclaves

The ARO Laboratory has one autoclave. Laboratory personnel are to follow the manufacturer's operating manual while using these autoclaves. Each operator is to make sure he or she is knowledgeable of all operating controls and safety devices before operating an autoclave. Additional precautions are listed below:

1. Use proper sterilizer loading procedures when placing materials in sterilizer chamber. All solid containers or instruments must be placed so that water or air will not be trapped in them.
2. Determine correct sterilization time by referring to minimum sterilization time chart or SOP. Sterilization will not be accomplished in less than a 15-minutes exposure time.
3. Opening autoclave door following sterilization: When the chamber pressure reading for an autoclave is zero, and the temperature reading is $\leq$ 50 degrees Celsius, the door for the autoclave may be opened. Be aware that hot steam may escape the autoclave chamber as the door is opened.
4. All **maintenance and repairs** of the controls and safety devices for an autoclave must only performed by certified technicians. If an autoclave is not functioning properly, contact the unit supervisor and schedule a maintenance/repair visit from a local autoclave vendor.
5. Prior to performing any cleaning or maintenance procedures, the autoclave should be at room temperature.
6. **Protection**: Always wear heat-protective gloves, safety glasses and lab coat when removing a processed load. Protective gloves and apron should also be worn when reloading sterilizer following previous operation.
7. When sterilizing **liquids**, to prevent personal injury or property damage resulting from bursting bottles and hot fluid, set the autoclave to LIQUIDS cycle (slow exhaust) and only use containers with vented closures (do not use rubber stoppers). When using bottles with screw-on caps, always make sure that the caps have been loosened from the bottle prior to placing the bottles in an autoclave. Do not use ordinary glass bottles or any container not designed for sterilization.
8. Avoid sudden full opening of the autoclave door at the end of a sterilization cycle. Carefully open the autoclave door to one or two inches, and wait at least ten minutes before unloading sterilizer.
9. Do not allow hot bottles to be jolted. This can cause hot bottle explosions! Do not move bottles if any boiling or bubbling is present. Allow bottles to cool to touch before attempting to move them from sterilizer shelf to storage area. Avoid steam by standing to the side when opening the door to the autoclave.
10. A steam supply malfunction may cause the sterilizer chamber to fill with scalding water. Do not open chamber door if the unit fails to complete an automatic cycle or if water leaks past the door gasket upon unlocking the door.
11. Sterilizing chamber should be drained at the end of each work day and left open to dry. The chamber should be cleaned periodically with water and a light detergent, using a non-abrasive sponge or cloth.

20.0 Laboratory Ventilation

General Building Ventilation:

The ventilation system in the ARO Laboratory building consists of a single pass-through airflow pattern, augmented by a chemical fume hood in the laboratory room. The single pass-through general exhaust system is designed such that the air entering the building is not re-circulated through the building, but instead is exhausted.

Chemical Fume Hood:

The chemical fume hood is the primary containment device in the laboratory to control airborne contaminants and fumes generated during experimental procedures. Chemical fume hoods provide protection to personnel by means of directional airflow. Air flows from the laboratory area into the hood through the face opening. The exhaust from the fume hood is discharged from an exhaust stack located on top of the building.

Employees are to use a chemical fume hood when:

* Procedures involve the use of volatile chemicals, as well as chemicals exhibiting strong odors.
* Chemical process results in generation of toxic vapors or aerosols.
* There is a need for additional physical protection against splash, spray, fire, or explosion.
* Procedures involve the use of a particularly hazardous substance.

Chemical Fume Hood Use

1. Instruction in the proper use of a fume hood should be provided to all lab employees during initial safety orientation and training.
2. The fume hood has been certified for use with the hood sash at a specified height. At this height (marked by a red-colored label), full containment of fumes is certified. Above the maximum certified height, full containment is not guaranteed. Note that the certified height has to be determined by using ASHRAE procedures, which involves air flow measurement, visual smoke test, and trace gas measurements. This testing should be conducted by outside, private fume hood vendor.
3. When conducting a procedure inside a fume hood, equipment and glassware should be at least 6 inches from the front of fume hood. An employee's face should remain outside of the fume hood and not break the plane of the hood opening.
4. The hood sash may be fully opened during set-up and cleaning procedures that do not involve hazardous chemicals.
5. During a procedure (e.g., digestion, extraction), the hood sash should be positioned below the maximum certified height, and preferably closed.
6. Maintenance of the laboratory fume hood, control box and motor should only be conducted by Facilities Maintenance personnel, a fume hood vendor, or a certified repair service. Laboratory employees are not authorized to perform maintenance on the operational controls of any chemical fume hood.
7. Fume hoods are not to be used for permanent storage of chemicals.
8. Hood work areas are to be clear of unnecessary equipment and materials that can disrupt airflow and block vents/baffles.
9. Lab procedures are to be planned so that, as much as possible, the materials needed for a procedure are present in the hood to eliminate disruption of airflow caused by carrying equipment in and out of the hood during a procedure.
10. While a procedure is in progress, doors adjacent to the fume hood in use are to be kept closed, with normal room traffic rerouted to another room entrance door. While lab equipment (block digestor, distillation system, etc.) in a hood is operating, the sash door should be positioned with the sash closed, if possible, or at least below the certified mark.
11. Use equipment with legs (so as to not disrupt air flow in the fume hood).
12. Apparatus in the hoods should be fitted with condensers, traps, or scrubbers to contain or collect solvent or toxic vapors.
13. When a procedure in a hood is completed, the hood is to be cleaned with an appropriate cleaner, and the hood sash is to be closed (hood sash windows should also be closed).
14. Report any problems with a fume hood to the unit supervisor or Central Laboratory CHO.

Fume Hood Evaluation:

1. The primary measurement used for evaluation of the laboratory fume hood is **face velocity**, which is a measure of air flow at the face plane of a hood. Air flow is measured in feet per minute (fpm) using a

velometer. Fume hood evaluations should be conducted every 3 months by each lab unit's Safety Committee representative (or other assigned employee).

2. Results for an air-velocity evaluation should be recorded on a ***Fume Hood Evaluation Worksheet*** (see Appendix). Completed forms should be kept on file in the lab unit, or with the ARO Laboratory CHO. These forms and any other written records for fume hood evaluations must be maintained by the lab unit or Central Laboratory CHO for a minimum of 3 years. The most current evaluation records should be stored in the laboratory unit, such that they are readily accessible to lab personnel.

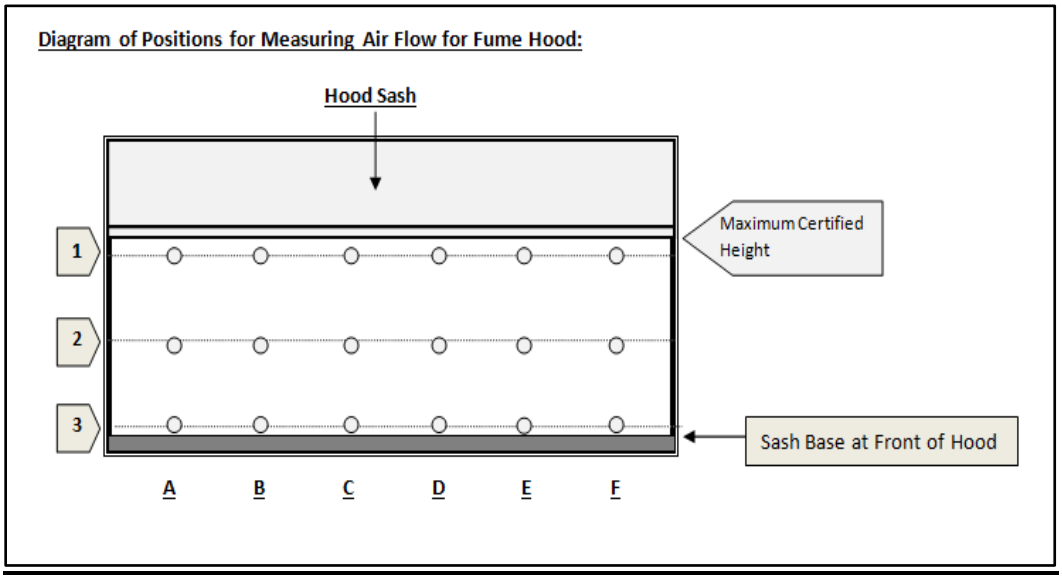
3. The evaluation process for a fume hood should include:

   * Measuring and recording air flow at the face opening of the fume hood
   * Mapping of the airflow at various positions across the face opening of the hood
   * Use of individual measurements to determine if air flow is being reduced by equipment inside of hood; use of average of air flow measurements to determine that face-level air velocity is acceptable (verifying that maximum sash height still guarantees fume containment)
   * General condition inspection

4. **Positions for Air Flow Measurements**:

   For air flow measurements, vertical and horizontal positions must be established to form a grid across the hood sash opening. These positions can be marked visually on the fume hood to assist in positioning the velometer.

   - Vertical Positions: 3
     (1) Below hood sash; (2) Mid-point between hood sash and base of hood;
     (3) Base of hood.
   - Horizontal Positions: 6
     Maximum of 6; start at or near the left side of sash opening, then evenly space other positions across the width of the sash opening.



5. **Set-Up for Air Flow Measurements**:

   - Position the hood sash at the Certified Maximum Height.
   - Close doors to the laboratory room that are near the fume hood.
   - If lab equipment is routinely maintained inside the fume hood, leave in place.

6. **Velometer:**
   Set the orifice dial (on the left side of the velometer) to Low; this setting corresponds to the bottom scale on the readout display (range of 0 to 200 feet per minute).

   To measure air flow, hold the velometer at a designated position. The velometer should be in the hood sash plane, in line with the hood sash base. The orifice dial should face out towards the lab area (the screen intake should face in towards the hood interior).

   Hold the velometer steady and allow the red needle to stabilize, and observe the reading (to nearest 5 fpm). Record the value on the evaluation worksheet. Repeat for all measurement positions.

7. **Acceptance Limits for Fume Hood Air Flow**:
   The general acceptance limits for face-level air velocity are 80 to 120 feet per minute.

8. In addition to the quarterly in-house evaluations, the laboratory fume hoods should also be tested by a certified fume hood vendor at a frequency of 1 to 2 years, or if in-house testing indicates possible problems with fume containment. This testing should include face-level air flow measurements and mapping, smoke test, and general inspection of fume hood sash and interior. Note that full ASHRAE testing is only required if there is a significant change to a fume hood, or if the certified maximum sash height needs to be confirmed or adjusted.

21.0 Biological Materials Hazards

ARO Laboratory employees may be exposed to biological material hazards. These hazards include bacteriological contamination of water samples, wildlife tissue samples, bacterial cultures, and contaminants in industrial wastewater samples. Proper handling of potentially contaminated samples can be achieved as follows:

1. Use appropriate personal protective equipment to protect against splash, spray, spill, or physical contact.
2. Equipment and containers used to contain, or used in test procedures involving biological material hazards, are to be autoclaved prior to washing or reuse.
3. Petri dishes used for plating out colony cultures are to be placed in an autoclavable biohazard bag and sterilized prior to disposal.
4. Storage of biological contaminants and the areas for biological contamination storage are to be clearly marked and labeled as having potential biological contamination.
5. Spills containing biological contaminants are to be cleaned up immediately, with contaminants placed in an appropriate biological material hazard bag. An appropriate sterilant is to be used on surfaces contacted by spilled material.
6. Work surfaces where biological materials have been handled are to be cleaned at the end of each work shift using an appropriate sterilant (e.g. 70% isopropanol).
7. Employees should regularly wash hands with warm water and soap.
8. Never pipette bacterial samples by mouth – always use pipette bulbs.

22.0 Radioactive Materials Hazards

No radioactive materials are present in the ARO Laboratory.

23.0 Particularly Hazardous Substances

In the normal course of work in the ARO Laboratory, employees may be exposed to chemicals that are designated as Particularly Hazardous Substances (PHS). A chemical identified as a PHS may or may not have severe acute effects, but with repeated exposure may pose a significant threat to human health. Exposure to a PHS may occur during procedures such as extraction or analysis of environmental samples, handling of chemical standards, or from the handling of environmental samples received from the field offices. Potential exposure routes include accidental ingestion, absorption through skin, eye contact, and inhalation.

A Particularly Hazardous Substance is a chemical or substance that falls under one or more of the following categories:

(1) **Carcinogen or suspect carcinogen:** a chemical that may cause cancer after repeated exposures. Determined by one or more of the following:

* OSHA publications, especially 29CFR1910, subpart Z, which is a list of carcinogens or potential carcinogens.
* National Toxicology Program's *Annual Report on Carcinogens*, 12th Edition, which identifies substances that are known or reasonably anticipated to be human carcinogens.
* IARC (International Agency for Research on Cancer) monographs, specifically chemicals that are listed in either Group 1 (carcinogenic to humans) or Groups 2A or 2B (probably or possibly carcinogenic to humans).
* MSDS for a chemical or standard solution (see note below). This mainly applies to vendor-prepared standards which contain a multitude of compounds.

(2) **Reproductive toxin:** a chemical confirmed as a reproductive toxin in the MSDS for the chemical (see note below). OSHA regulations (1910.1450) define reproductive toxins as "chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

(3) **Compound exhibiting high acute toxicity:** a chemical for which the toxicity data from MSDS for chemical (see note below) fall within OSHA's criteria for high toxicity. According to OSHA, these compounds may be fatal or cause damage to target organs after a single exposure or repeated exposures of short duration. OSHA regulations (1910.1200 Appendix A) define a chemical as highly toxic if it falls into one of the following categories:

- Oral: median lethal dose (LD50) ≤ 50 milligrams per kilogram of body weight, as administered orally to albino rats.
- Skin contact: LD50 ≤ 200 milligrams per kilogram of body weight, as administered by continuous contact for 24 hours with the bare skin of albino rabbits.
- Inhalation: median lethal concentration (LC50) in air of ≤ 200 parts per million by volume of gas or vapor, or ≤ 2 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour to albino rats.

Note that for MSDS forms, information regarding carcinogenic effects, reproductive toxicity, and acute toxicity will generally be located under sections titled *Hazards Identification* (potential chronic health effects) and/or *Toxicological Information*.

In the Laboratory: A table listing the chemicals and solutions used in the Central and/or ARO Laboratories that have been identified as Particularly Hazardous Substances is provided in the Forms Appendix.

Exposure Monitoring:

In areas of regular use, exposure of employees to Particularly Hazardous Substances for which inhalation is a significant exposure route should be monitored periodically. Exposure monitoring should assess the level of exposure at or near an employee's breathing zone. Exposure limits for air contaminants are published as Permissible Exposure Limits (PEL's), which are generally based on 8-hour work shifts. Air exposure limits are in OSHA regulations (29CFR 1910.1000, Subpart Z, Tables Z-1 and Z2) and in MSDS forms.

Every effort is made to ensure that employees are not exposed to ambient air concentrations above the limits established by these regulations. If exposure monitoring of an employees' breathing zone indicates that exposure levels reach or exceed the limits for a PHS, then more rigid control measures should be instituted to include:

- Additional engineering controls
- Administrative controls such as limiting the exposure time
- Use of appropriate personal protective equipment.

Working with a Particularly Hazardous Substance:

The key to safely working in close proximity to a particularly hazardous substance is limiting the amount of direct exposure an employee may have to the chemical or substance. General rules for working with these substances include:

1. If possible, work with a particularly hazardous substance under a fume hood. Verify that the fume hood is operating properly **BEFORE** beginning work with the substance.
2. Personal protective equipment that is appropriate for the substance must be in use whenever the substance is handled. At a minimum, safety glasses, gloves, and a lab coat must be worn while working with a PHS.
3. Communicate the hazards and emergency response procedures to all persons in the area **BEFORE** working with the substance.
4. Working with a particularly hazardous substance requires that at least one other employee is present in the work area. The other employee should be aware and knowledgeable of the procedure to be used, the potential dangers of the chemical or substance, and the emergency response activities in case of a spill or accident (decontamination procedures, waste accumulation and disposal procedures).
5. Information for a particularly hazardous substance should be included in the Standard Operating Procedure (SOP) or other written instructions for the procedure(s). Information should include the hazard presented by the chemical, potential exposure routes, any special protective equipment beyond the standard personal protective equipment, and emergency procedures for accidental spills of the chemical.

24.0 Chemical Waste Management

Waste is considered hazardous if it has one or more of the following characteristics:

* **Ignitability**: flammable or easily combustible with flashpoint below 140^{o} F (e.g. organic solvents).
* **Corrosivity**: acids or bases, pH less than 2 or greater than 12.5; capable of corroding metal containers.
* **Reactivity**: unstable at normal temperature and pressure; can cause explosion, release toxic fumes, vapors, or gasses when heated, compressed, or mixed with water.
* **Toxicity**: harmful or fatal when ingested or absorbed (e.g., mercury).

Chemicals used in the ARO Laboratory may fall within the above parameters. Therefore, whenever wastes are generated from chemicals that exhibit any of the characteristics listed above, they are to be treated as hazardous wastes.

Additional guidelines regarding hazardous waste and chemical waste management:

1. Waste containers (if needed) must be clearly labeled as for the collection of hazardous chemical wastes.
2. All receptacles for hazardous waste should be resistant to the materials and should be placed in a chemically resistant tray of sufficient volume to contain a rupture of the primary container.
3. Liquid wastes are to be stored in screw-capped bottles or safety cans. Maintain a headspace – avoid completely filling waste containers.
4. Chemical Waste should be segregated into solids and liquids. Liquids should be segregated into acids, bases, organic solvents, or other classification. Solid waste should be segregated by hazard class.
5. Certain chemical wastes (e.g., heavy metals, cyanides, carcinogens, contaminated protective clothing) should be accumulated in separate containers to avoid chemical reactions and to assist in classifying waste for disposal.

25.0 Biological Waste Management

Biological wastes are to be handled as follows:

1. Petri dishes used for plating out colony cultures are to be placed in an autoclavable biohazard bag and sterilized prior to disposal.
2. Containers and storage areas must be labeled properly, and are to be clearly marked as having potential biological contaminants.

FORMS APPENDIX

Certification of Unit Safety Training - Laboratory

Water Sciences Section - Division of Water Resources

Employee Name:	
Laboratory Unit:	
Supervisor Name:	
Designated Trainer:	

With my signature below, I acknowledge that I have been instructed by my unit supervisor (or designated trainer) on the health and safety hazards present in my current work area(s) (list room numbers:_____) and the proper safety procedures to follow when working in these areas. The hazards and procedures are outlined in the Laboratory Section Chemical Hygiene Plan, as well as Standard Operating Procedures for the lab unit.

I understand these hazards and accept them as a necessary part of my work.

I will follow the proper safety procedures in my work area at all times.

Employee Signature	**Date**
Supervisor Signature	**Date**

M:/LABFORMS/TRF-003-1 (COU) Revised: 5/2014

New Employee Safety Orientation & Training

Chemistry Laboratory - Water Sciences Section - N.C. Division of Water Resources

Date of Orientation:	
Name of Employee:	
Orientation Instructor:	

Safety Overview	
	Recognizing Work-Area Hazards
	Safety Devices available in Laboratory and Unit
	Reporting Accidents and Injuries
	First Aid Kits
	Fire Prevention Guidelines
	Housekeeping Rules, Clothing, Washing Lab Coats
Personal Protective Equipment	
	Location
	Instructions for Use
	Additional Protective Equipment used in Unit
Evacuation Plan	
	When to Evacuate Building and Where to Go
	Alarm System
General Laboratory Hazards	
	Equipment Hazards
	Electrical Hazards
	Compressed Gas Cylinders
	Autoclaves
	Vacuums
	Noise Exposure
Fume Hoods	
	When and How to Use a Fume Hood
	Alarm
Chemicals	
	Overview of Chemicals used in the Laboratory
	Hazardous Chemicals used in Unit
	Material Safety Date Sheets
	Storage, Compatibility, Spill Response
	Transporting Chemicals
	Disposal of Hazardous and Toxic Chemicals
Other Safety Issues for Unit	

By signing below, the employee and instructor verify that the above items were discussed and understood.

Signature of Employee **Date**

Signature of Instructor **Date**

M:/LABFORMS/TRF-005-1 (NES) Revised: 5/2014

EMERGENCY NOTIFICATION INFORMATION

North Carolina Department of Environment and Natural Resources

Division of Water Resources - Water Sciences Section

4405 Reedy Creek Road, Raleigh, NC 27607

Mailing Address: 1623 Mail Service Center, Raleigh, NC 27699-1623

Telephone: 919-733-3908 Fax: 919-733-6241

This confidential information should be kept in a sealed envelope, which will be stored in a locked filing cabinet in the front office. This form will only be used in the event of an emergency.

Date Completed:		**Employee ID number:**	
Name:			
	First	*Middle initial*	*Last*
Home Address:			
	Street		*City*
	State	*Zip Code*	*County*
Home Telephone:			
Age:		**Date of Birth:**	
		Month	*Day* / *Year*
Sex:	☐ Male ☐ Female	**Marital Status:**	☐ Married ☐ Single
Primary Health Insurance:			
Provider:	☐ State Health Plan - Blue Cross Blue Shield	☐ Other:	
Subscriber ID:			
Group Number:			
Telephone No.:			
Primary Physician:		**Telephone:**	
Prescription Medications (name, dosage, frequency):			
Any Medical Conditions or Allergies?	☐ Yes ☐ No		
If Yes, Please Describe:			
Do you wear contact lenses?	☐ Yes ☐ No	Are You an Organ Donor?	☐ Yes ☐ No
Person to Contact in Case of Emergency			
Name:		Relationship:	
Home Telephone Number:			
Cell Phone Number:			
Work Telephone Number:			
Person to Contact in Case of Emergency			
Name:		Relationship:	
Home Telephone Number:			
Cell Phone Number:			
Work Telephone Number:			
		Revised:	7/15/2014

Fume Hood Evaluation Worksheet

NCDWR-Water Sciences Section, 4405 Reedy Creek Road, Raleigh, NC 27607

Hood ID:		**Lab Unit:**		**Room Number:**	
Date of Evaluation:				**Initials:**	
Lab Door(s) Closed?	Yes / No (Circle One)			**Hood Baffle:**	Open
Position the Hood Sash at Maximum Certified Height - Hood Opening Measurements:					
Height (inches):		**Width (inches):**			
Hood Monitor Display:	( ) Normal ( ) Alarm Light Flashing ( ) Other:				

Fume Hood Face-Velocity Measurements (feet per minute, fpm)

Vertical Position	**Height (inches)**	**Horizontal Position**						Average fpm
		A	**B**	**C**	**D**	**E**	**F**	
1 (below hood sash)								
2 (mid-point)								
3 (base of hood)								
Distance from Left Side (in.):			**Distance between Positions (in.):**					

Comments:

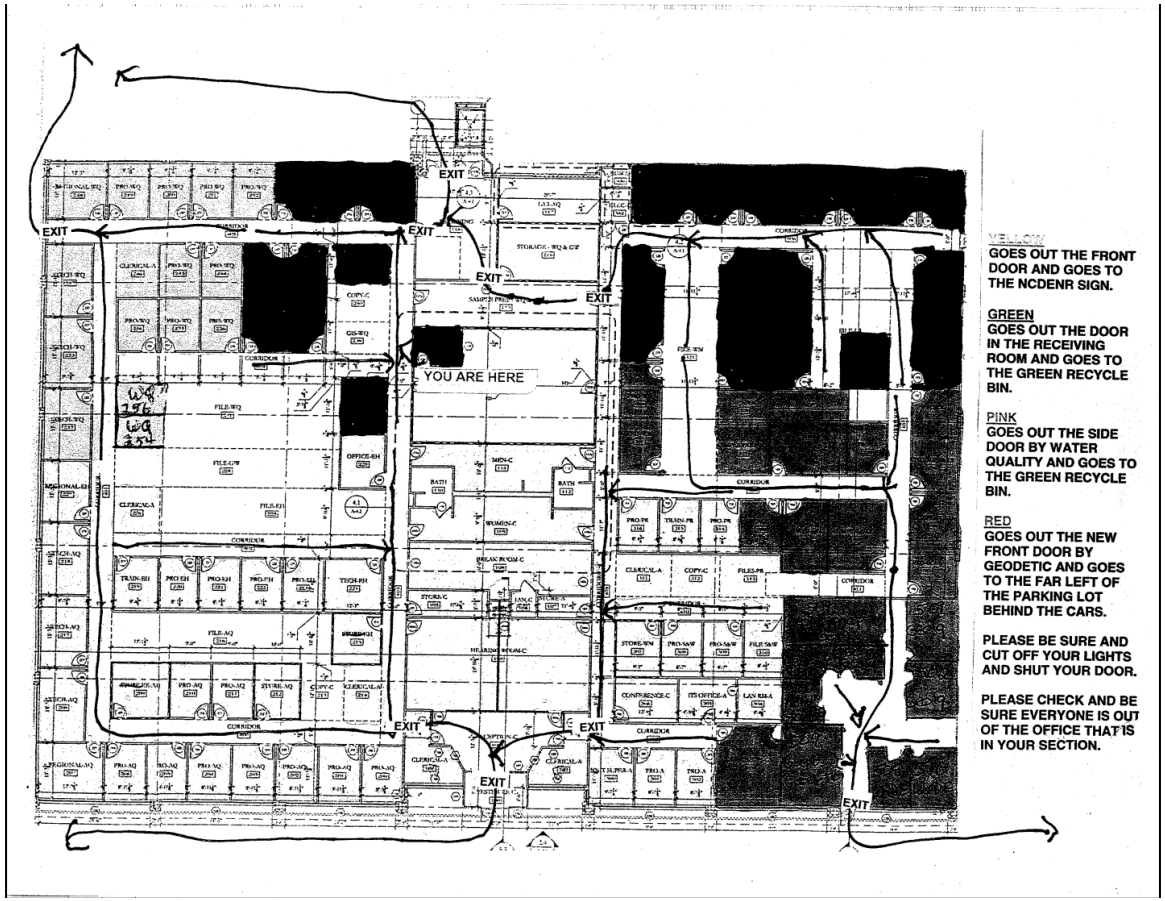
Date of Evaluation:				**Initials:**	
Lab Door(s) Closed?	Yes / No (Circle One)			**Hood Baffle:**	Open
Position the Hood Sash at Maximum Certified Height - Hood Opening Measurements:					
Height (inches):		**Width (inches):**			
Hood Monitor Display:	( ) Normal ( ) Alarm Light Flashing ( ) Other:				

Fume Hood Face-Velocity Measurements (feet per minute, fpm)

Vertical Position	**Height (inches)**	**Horizontal Position**						Average fpm
		A	**B**	**C**	**D**	**E**	**F**	
1 (below hood sash)								
2 (mid-point)								
3 (base of hood)								
Distance from Left Side (in.):			**Distance between Positions (in.):**					

Comments:

Map of Asheville Regional Office:



List of Particularly Hazardous Substances: Water Sciences Section, 4405 Reedy Creek Road

Chemical	Chemical Form	Location in Laboratory	Source of Hazard Designation
Carcinogens			
Benzene	Component of VOC mixture	Volatiles	OSHA[1], NTP[2], IARC (1)[3]: known carcinogen
Beryllium	Component of standard mixture	Metals	NTP, IARC (1): known carcinogen
Cadmium	Solid; component of standard mixture	Metals; Nutrients	OSHA, NTP, IARC (1): known carcinogen
Chloroform	Liquid	Wet Chemistry	NTP, IARC (2B): suspect carcinogen
Chromic acid	Component of digestion solution	Wet Chemistry	MSDS (contains chromium (VI))
Chromium (VI)	Component of standard mixture	Metals; Wet Chemistry	OSHA, NTP, IARC (1): known carcinogen
Formaldehyde	Liquid	Wet Chemistry	OSHA, NTP, IARC (1): known carcinogen
Lead compounds	Component of standard mixture; lead acetate	Metals; Wet Chemistry	OSHA, NTP, IARC (2A): suspect carcinogen
Methylene chloride	Liquid solvent	SV/PE[4]	OSHA, NTP, IARC (2A): probable carcinogen
Nickel and nickel compounds	Component of standard mixture	Metals	NTP, IARC (1): known carcinogen
Phenolphthalein	0.5% Solution	Wet Chemistry	NTP, IARC (2B), MSDS: suspect carcinogen
Polychlorinated biphenyls (*Arochlor*)	Component of Pesticides standard mixtures	Pesticides	NTP, IARC (1): known carcinogen
Potassium dichromate	Solid	Wet Chemistry	NTP, IARC (1): known carcinogen
Standards for SV/PE[5]	Vendor-prepared standard mixtures	SV/PE	MSDS's for standards
Standards for Volatiles[5]	Vendor-prepared standard mixtures	Volatiles	MSDS's for standards
Vinyl Chloride	Component of VOC Gas mixture	Volatiles	OSHA, NTP, IARC (1): known carcinogen
Reproductive Toxins			
Ether	Liquid	SV/PE	MSDS
n-Hexane	Liquid	Wet Chemistry	MSDS
Lithium	Component of standard mixture	Metals	MSDS
Mercury	Component of standard mixture, thermometers	Metals	MSDS
Potassium dichromate	Solid	Wet Chemistry	MSDS
Pyridine	Liquid	Wet Chemistry	MSDS
Sodium Tetraborate	Solid	Nutrients	MSDS
Toluene	Liquid	Organics	MSDS
Substances with High Acute Toxicity			
Phenol	Liquid	Nutrients	MSDS
Potassium cyanide	Component of standard solution	Wet Chemistry	MSDS
Potassium dichromate	Solid	Wet Chemistry	MSDS (dermal and inhalation)
Standards for SV/PE	Vendor-prepared standard mixtures	SV/PE	MSDS's for standards

[1] OSHA = Occupational Safety and Health Administration; [2] NTP = National Toxicology Program

[3] IARC = International Agency for Research on Cancer (carcinogen grouping: 1 = known; 2A = probable; 2B = possible)

[4] SV/PE = Semi-volatiles and Pesticides

[5] Vendor-prepared standards for the SV/PE and volatiles units contain components that are carcinogenic; please refer to MSDS's for more information. **Date Prepared: 11/2017**

APPENDIX A

Laboratory Chemical Spill Plan

NC Department of Environmental Quality
Division of Water Resources - Central Laboratory

Laboratory Chemical Spill Plan – 9/2015

1. Emergency Assistance

Call **9911** (City of Raleigh Emergency Response) to assist with the following:

- medical assistance for injuries
- fires
- explosions
- chemical spills for which assistance is required

Emergency Response personnel will dispatch appropriate response personnel.

When you call, you should be ready to provide the following information:

- What is the **name** of the chemical spilled?
- What **quantity** of the chemical has spilled?
- **Where** is the spill (building location and floor number)?
- Has anyone come **in contact** with the chemical?
- Is anyone **injured**?
- Is a **fire or explosion** involved?
- What is **your name** and **phone number**?

2. Spill Preparedness

Most laboratory spills and many small chemical spills outside the laboratory work area can be safely handled by laboratory personnel. Some spills should only be mitigated by specially trained emergency response personnel.

It is prudent to make preparations for dealing with spills before they occur. This section provides basic emergency preparedness information and gives general guidance on how to respond to chemical spills.

A. Preventing spills: Listed below are some basic spill prevention steps that apply to storage, transportation, and transfer of chemicals.

General precautions:

- reduce clutter and unnecessary materials in your work area
- eliminate tripping hazards and other obstructions
- have all needed equipment readily available before starting work
- take your time – don't rush through your task

Storage precautions:

- use sturdy shelves
- do not store above eye level
- store larger containers closer to the floor
- containers should be stored at the rear of shelves
- storage shelves should have raised edges ("lips")
- store chemicals first by compatibility, then alphabetically
- inspect the storage area regularly for leaking or defective containers
- use storage containers appropriate for the stored materials
- do not store unprotected glass containers on the floor

- use spill proof trays or bottle carriers in acid cabinets

Transportation precautions:

- use high-walled carts, where appropriate
- use safety containers, where appropriate
- use bottle carriers or a cart for 2.5 and 4.0 liter bottles
- use straps to secure containers, where appropriate
- consider potential hazards and escape routes before transporting chemicals
- consider purchasing plastic coated "shatter resistant" bottles

Precautions in transferring chemicals:

- pay careful attention to the size of container to avoid overfilling
- transfer only the quantity needed
- if possible, use pumps or other mechanical devices rather than pouring
- provide containment to capture leaks and spills

B. Preparing for spills

Before working with chemicals, you should determine what may go wrong and how you will respond to a spill. Organize any spill response by establishing protocols and evaluating potential hazards in advance. Become familiar with Safety Data Sheets for commonly used hazardous chemicals, and review SDSs prior to using an unfamiliar material. Make sure that you have all necessary personal protective devices and safety equipment. Ensure that proper containment and clean up materials are readily available and easily accessible. Each individual who may be involved in spill response must know the location, purpose and limitations of all personal protective equipment, safety equipment and clean up materials.

Spill control kits: Spill control materials have been made available and are located in the laboratory work areas. Prepackaged kits are also available. Kits will include several items that may be needed for handling a chemical spill such as:

- Disposable, chemical resistant gloves
- Safety goggles
- Absorbent pillows and/or pads
- Plastic bags for containing absorbent material
- Neutralizing agents
- Plastic pails

The spill control kits are clearly marked. All lab personnel should know their location, be familiar with their contents, and understand their limitations.

C. Defining and classifying a spill

There are two basic types of spills: **mercury spills** and **chemical spills**.

Mercury spills require assistance for safe and proper collection. A mercury spill kit is available and located in the laboratory stock room. Request assistance from laboratory supervisors or others trained in the use of the spill kit.

Chemical spills can be broken down into two basic types: simple spills, which you can clean up yourself, and complicated spills, which require assistance.

If the spill meets ANY of the following conditions of a complicated spill, call **9911** immediately.

A spill is complicated if:

- a person is injured
- identity of the chemical is unknown
- multiple chemicals are involved
- the chemical is highly toxic, flammable or reactive
- the spill has the potential to spread to other parts of the building (such as through the ventilation system)
- the cleanup procedures are not known or appropriate materials are not readily available
- the spill may endanger the environment (such as reaching waterways or outside ground)

3. HANDLING CHEMICAL SPILLS

A. Evaluate hazards

When spills occur, a quick and appropriate response can prevent serious consequences. Improper response can make things worse. In order to respond promptly and appropriately, you should evaluate potential hazards before using any chemicals. The first source of information to consult should be the Safety Data Sheets (SDS). SDSs may be found in white notebooks located in the front office area of the Chemistry Laboratory Building. Of greatest concern in spill situations are chemicals that are:

- air reactive
- water reactive
- flammable
- polymerizable
- corrosive
- toxic

Based on these hazards, you can then determine:

- appropriate personal protective equipment for spill response
- types of fire suppression equipment
- appropriate cleanup materials
- first aid procedures

B. Specific spill response measures for simple spills

- **Notify laboratory supervisors and coworkers of the spill.**
- **Prevent the spread of fumes and vapors.** If the substance is volatile or can produce airborne dusts, close laboratory doors to isolate the area.
- **Control the spread of liquids.** Contain the spill by using absorbent material such as Spill-X, Oil-Dri, cat litter, vermiculite, or spill pillows. Place absorbents or spill pillows at the outer edges of the spill. (***Do not use silica [sand] based products with hydrofluoric acid.***)
- **Neutralize acids and bases.** Spills of acids or bases should be neutralized unless toxic fumes are present. Exercise caution in neutralizing spills as the reaction can be vigorous, causing spattering and heat.
- **Absorb liquids.** Add the absorbents to the spill, working from the outer edges toward the center. Absorbent materials such as Spill-X, Oil-Dri, cat litter, or vermiculite work well, but can be difficult to clean up. Spill pillows are easier to use and clean up.
- **Collect and contain the cleanup residues.** Spill residues and cleanup materials should be collected and placed into a plastic container. If the residues are totally dry, they may be placed in a plastic bag. Place a descriptive label on any residue container.
- **Decontaminate the area and affected equipment.** Ventilate the area if necessary. For most hard surfaces, conventional cleaning with soap and water is appropriate.
- **Dispose of the wastes.** Laboratory supervisors will provide guidance for disposal of wastes.

C. Specific spill response measures for complicated spills

- **Notify the safety officer, supervisors, and coworkers.**
- **Evacuate the area.** Leave the spill area; alert others in the area. Without endangering yourself: remove victims to fresh air, remove contaminated clothing, and flush contaminated skin with water for 15 minutes. If anyone has been injured call **9911** immediately. It may be necessary to evacuate the building for extremely toxic spills.
- **Confine the spill area.** When everyone is safely out of the area, close doors and isolate the spill area. If the spill involves a flammable material, disable electrical supply using the red buttons outside the laboratory area.
- **Report the spill.** From a safe location, call **9911**. Report that has been a chemical spill at the DEQ Chemistry Laboratory / 4405 Reedy Creek Road, and give the name of the chemical, the quantity spilled, spill location (building location), the extent of any injuries, whether a fire or explosion is involved, and your name and phone number.
- **Secure the area.** Until emergency responders arrive, block off areas leading to the spill, lock doors, and post signs or warning tape to alert others of the spill. Post staff by commonly used entrances to the area in order to direct people toward other routes. Arrange for someone to meet the emergency responders at the main entrance to the complex.
- **Clean up the spill.** After emergency responders have controlled the spill, consult with the safety officer or supervisors to determine other needed cleaning procedures. In some cases, this may be done by laboratory personnel; in other cases, an outside contractor may be required.

D. CLEANING UP HAZARDOUS MATERIALS SPILLS

1) Slightly Hazardous Materials (Weak Acids, Bases, Oils, etc.)

   - Absorb using paper towels, Spill-X-A for acids / Spill-X-C for caustics, and/or spill-control pillows. Refer to **Appendix B** for Spill-X procedures.
   - Transfer to a plastic bag, place in trash container for solid wastes. Clean floor (or other spill surface) thoroughly with soap and water; dry surface completely to prevent slips or falls.

2) Mercury Spill

   - Contact laboratory supervisors to perform the cleanup
   - Contain the spill in a small area and warn co-workers not to enter the area.
   - Use gloves; reduce any sources of heat that might volatilize the mercury. Do not use an ordinary vacuum cleaner; it will aerosolize and spread the mercury through the laboratory.
   - If the mercury has reached a porous surface (floor, lab bench, etc.), special chemical inactivators must be used. The mercury spill kit is located in the laboratory stock room. Refer to **Appendix C** for the mercury spill kit procedure.
   - Several cleanings may be necessary to remove all of the mercury.

3) Concentrated Acids/Bases

   - Wear heavy gloves that are acid resistant, goggles, and body protection (lab coat and rubber apron).
   - Take care not to step in the spilled materials.
   - Absorb the spill using acid or base Spill-X and/or absorbent pillows. **DO NOT USE PAPER PRODUCTS**.
   - Products designed to neutralize acids or bases can produce large amounts of heat and may splatter. Treat the spill in small sections.
   - Verify the material is neutralized by checking pH (see Spill-X procedure.) Carefully place the neutralized materials into bags and properly dispose.
   - Clean the area thoroughly with soap and water; ensure that the area is dry to prevent slipping.

4) Flammable/Volatile Chemicals

- If possible, immediately extinguish all open flames.
- Shut down all sources of ignition (sparking equipment, open flames, etc.). This can be done using the electric supply cutoffs (red buttons) in the hallways outside each laboratory.
- Remember, for explosive gases, the spark from turning on a light switch can be sufficient to ignite the gas.
- Vapors can migrate from open containers or spills. Open containers of flammable materials should be isolated within a fume hood or appropriate storage cabinet during spill cleanup.
- Alert other workers present in the lab and seek assistance if necessary.
- Use gloves to protect your skin. Ensure that you are using the proper glove material (see **Appendix D** for a glove compatibility guide.)
- Absorb the spill using spill-control pillows and/or Spill-X-S adsorbent materials designed for volatile agents.
- Place the saturated pillow or absorbent materials into a hazardous waste bag and place the bag into a fume hood or outside the main laboratory, if possible.
- Use a shovel, scoop or broom to remove the material. All utensils coming in contact with the spilled substance must be cleaned or discarded.
- Clean up the contaminated area using soap and water.

E. Special Precautions

1) Special precautions for flammable liquids

- Remove all potential sources of ignition, when possible. If, however, the vapors from a flammable spill are in the vicinity of an ignition source it may be advisable to shut off power using the electrical system cutoffs (red buttons) outside each laboratory area. Notify supervisors for assistance.
- If respiratory protection is necessary, contact **9911**.
- Contain spill cleanup materials in a sturdy plastic bag and label.
- Never use a vacuum cleaner to collect flammable liquids.
- Thoroughly ventilate the area when cleaning is completed.

2) Special precautions for acids

- Protect skin and eyes from direct contact with the acid.
- Respiratory protection may be necessary; call **9911** if needed.
- Neutralize the spill with carbonate or bicarbonate of sodium or potassium. The neutralization reaction is sometimes vigorous, so be alert for splashes.
- Use pH paper to verify that the acid has been neutralized.
- Special precautions should be taken when cleaning up hydrofluoric acid (HF) spills. Do not use silica [sand] based products with hydrofluoric acid.

3) Special precautions for powder spills

- Before starting, close windows and doors to reduce drafts.
- Carefully sweep up the powder to minimize dust. Place all residues in a sealed container.
- If needed, use a dust mask or respirator, as appropriate. You must be certified to wear a respirator.

4) Special precautions for mercury spills

- Laboratory supervisors should assist with the cleanup.
- Cordon off the area to prevent the mercury from spreading.

- If you break a mercury thermometer, a mercury spill kit is available for cleaning up the spill. Place any contaminated items from the kit, and the broken thermometer, in a sturdy plastic bag. Close and label the bag "Broken mercury thermometer". Do NOT use a regular vacuum cleaner or shop vac. **Note**: The best method for dealing with mercury spills is to prevent them in the first place. Examine all uses of mercury to determine if substitutes are available. Store devices containing mercury in trays or other equipment that provide containment in the event of a spill.
- Refer to **Appendix C** for a mercury spill kit procedure.

4. EXPOSURE TO CHEMICALS

A. **If a chemical comes in contact with skin**, wash the area immediately using warm water and a strong soap such as dishwashing detergent. Do not use alcohol, acetone, or other solvents (these will facilitate absorption of the chemical through the skin).

B. **Splashes into eyes, nose, or lip area** must be removed immediately using an eyewash station/hose or by placing the area under a steady stream of lukewarm running water. A mild soap may be used for the lips and nose, but only running water is to be used for the eyes. It is important that the eyes be held open in the stream of water and that contact lenses are removed to facilitate cleansing of the eyes. Roll the affected eye during rinsing, which should continue for at least 15 minutes. Seek medical attention immediately.

C. **If a chemical has been spilled onto clothing or other parts of the body**, remove any contaminated clothing or jewelry immediately and wash the affected area with warm water and soap for at least 10 minutes. Contact with phenol, solutions containing dimethyl sulfoxide (DMSO), cyanate or pyridine can be especially serious, since these compounds pass through the skin and into the bloodstream rapidly. Dispose of contaminated clothing in the same manner as chemical wastes. Do not reuse clothing and lab coats contaminated with a hazardous substance. Seek medical attention.

D. **If a toxic substance is inhaled**, the substance is absorbed rapidly into the bloodstream. Personnel exposed in such a manner should leave the contaminated area and seek immediate medical attention. Attempt to cough up as much mucous as possible and rinse mouth with water. Qualified personnel should remove incapacitated or unconscious victims from the contaminated area only with the use of SCBA (self-contained breathing apparatus). Never attempt to remove a victim from a room containing toxic vapors without using a protective breathing apparatus. Be cautious about using CPR on a person who has inhaled toxic vapors in order to prevent cross-contamination. Place warning signs at the room entrance where the accident occurred to indicate contaminated area. Employees exposed to toxic substances should be referred to medical personnel for further evaluation.

E. **If materials have been ingested**, rinse mouth with warm water repeatedly. If corrosives were ingested, do not attempt to neutralize the chemical by any means unless directed to do so by medical personnel. Do not attempt to induce vomiting if corrosives have been swallowed since this may damage the esophagus. If other toxic substances have been swallowed, water may be used to dilute the toxin. Vomiting may be induced only if corrosives or hydrocarbons (petroleum distillates) are not involved. Seek medical attention and be prepared to inform the medical authorities about the nature and approximate amount of chemical that was ingested.

Appendix B:

Gloves and Chemical Resistance

Chemical Resistance of Gloves – Quick Guide:

Nitrile gloves:

Acetone - fair

Ethanol - excellent

Isobutyl alcohol - excellent

Isopropyl alcohol - excellent

Methanol - fair

Latex gloves:

Acetone - good

Ethanol - excellent

Isobutyl alcohol - poor

Isopropyl alcohol - excellent

Methanol - fair

PVC gloves:

Acetone - poor

Ethanol - excellent

Isopropyl alcohol - good

Methanol - good

Viton gloves & Butyl gloves:

Acetone - good

Glove Selection Guide:

Chemical	Incidental Contact	Extended Contact
Acetic Acid	nitrile	neoprene, butyl rubber
Acetone	natural rubber (latex) (8 mil thick)	butyl rubber
Acetonitrile	nitrile	butyl rubber, polyvinyl acetate (PVA)
Ammonium Hydroxide	nitrile	neoprene, butyl rubber
Arsenic or Cadmium Salts	nitrile	
Carbon Tetrachloride	nitrile (8 mil), double glove	viton
Chloroform	nitrile (8 mil), double glove	viton, PVA
Copper (Cupric) Sulfate	nitrile	
Dichloromethane (Methylene Chloride)	nitrile (8 mil), double glove	viton or PVA
Ethanol	nitrile	
Ethyl Ether	nitrile (8 mil), double glove	PVA
Formaldehyde	nitrile	
Hexane	nitrile (8 mil), double glove	nitrile (>35 mil), viton, PVA
Hydrochloric Acid	nitrile	neoprene, butyl rubber
Isopropanol	nitrile	
Mercury	nitrile	
Methanol	nitrile	
Organophosphorus compounds	nitrile (8 mil), double glove	
Phenol	nitrile (8 mil), double glove	neoprene, butyl rubber
Silver Nitrate	nitrile	
Sodium Dodecyl Sulfate	nitrile	
Sulfuric Acid	nitrile (8 mil)	neoprene, butyl rubber (>20 mil)
Toluene	nitrile (8 mil), double glove	viton, PVA
Xylene	nitrile	PVA, viton

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